CUSTOMER NO.: 38107

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of H. BRAESS	)	Examiner: N. BITAR
Serial No.: 10/578,447	)	Art Unit: 2624
Filed: May 8, 2006	)	Confirmation: 6977
For: **DEVICE AND METHOD FOR DETERMINING THE CONCENTRATION OF A TRACER IN BLOOD**	)	
Date of Final Office Action: October 30, 2008	)	
Attorney Docket No.: PHDE030380US/PKRZ201311US	)	Cleveland, OH 44114 April 1, 2009

BRIEF ON APPEAL

CERTIFICATE OF ELECTRONIC TRANSMISSION

I certify that this **BRIEF ON APPEAL** and accompanying documents in connection with U.S. Serial No. 10/578,447 is being filed on the date indicated below by electronic transmission with the United States Patent and Trademark Office via the electronic filing system (EFS-Web).

April 3 2009
Date

Patricia A Heim
Patricia A. Heim

I. STATEMENT OF REAL PARTY IN INTEREST (41.37(f))

The real party in interest for this appeal and the present application is Koninklijke Philips Electronics, N.V.

II. STATEMENT OF RELATED CASES (41.37(g))

None.

III. JURISDICTIONAL STATEMENT (41.37(h))

The Board has jurisdiction under 35 U.S.C. 134(a).

The Examiner mailed a final rejection on October 30, 2008, setting a three-month shortened statutory period for response.

The time for responding to the final rejection expired on January 30, 2009. Rule 134.

A notice of appeal and a request for a one-month extension of time under Rule 136(a) was filed on February 10, 2009.

The time for filing an appeal brief is two months after the filing of a notice of appeal. Bd.R. 41.37(c). The time for filing an appeal brief expires on April 10, 2009.

The appeal brief is being filed on the date set forth on the Certificate of Transmission.

IV. TABLE OF CONTENTS (41.37(i))

V. TABLE OF AUTHORITIES (41.37(j))

Not applicable.

VI. STATUS OF AMENDMENTS (41.37(l))

Amendment C of December 29, 2008 was not entered.

An Amendment After Final is being submitted herewith to address the 35 U.S.C. § 112 issue. Because this amendment merely reduces the issues on appeal, it is believed that the amendment will be entered.

VII. GROUNDS OF REJECTION TO BE REVIEWED (41.37(m))

Whether claims 1-11 and 17 distinguish patentably over Ogino (US 6,985,613) as modified by Salem ("X-Ray Computed Tomography Methods For In Vivo Evaluation of Local Drug Release Systems") as further modified by Lambrecht (US 5,019,323).

Whether claim 10 complies with 35 U.S.C. § 112, second paragraph.

VIII. STATEMENT OF FACTS (41.37(n))

1. PET is the acronym for positron emission tomography which measures the distribution of a radionuclide in the body of a patient from annihilation quanta produced after the release of positrons (present application, page 1, lines 5-7).

2. The annihilation process generates two gamma quanta γ_1, γ_2 whose direction of flight is diametrically opposite (present application, page 5, lines 22-34).

3. Because the gamma quanta travel in opposite directions, the annihilation event must have occurred on the line, called in the present application a "reaction line", between the two detectors which detected the pair of quanta γ_1, γ_2 (present application, page 5, lines 22-34).

4. In time-of-flight positron emission tomography (TOF-PET), the detectors have such a high temporal resolution that differences in the time-of-flight of the two gamma quanta γ_1, γ_2 of the annihilation pair can be measured (present application, page 6, lines 1-12).

5. From this difference in the time-of-flight of the pair of gamma quanta, the location along the reaction line at which the annihilation event occurred can be calculated (present application, page 6, lines 1-12).

6. Ogino uses time-of-flight to describe a magnetic resonance technique for measuring a flow rate of blood (Ogino, column 11, lines 38 63).

7. Time-of-flight PET relates to localizing the annihilation event; whereas, time-of-flight MR connotes measuring blood flow (Ogino, column 1, lines 22-31).

8. In magnetic resonance imaging, the subject is placed in a static magnetic field, gradient magnetic fields and high frequency magnetic fields are applied to cause spins within the object to generate RF magnetic resonance signals (Ogino, column 1, lines 15-21).

9. Ogino is particularly interested in having good contrast between blood and other tissues, so that it can be clearly seen in the resultant images (Ogino, column 15, lines 29-38).

10. Figure 1 of Lambrecht is directed to a high pressure liquid chromatography system which is used to prepare solutions (Lambrecht, column 2, lines 64-66).

11. Page 1312, column 2, paragraph B of Salem relates to display format and makes no suggestion nor does it even address combining a 3D PET device and a TOF-PET unit and an image producing device.

12. Neither Figure 16 of Ogino, nor the description of it at column 16, lines 47-62 describe or discuss segmenting an image. Rather, this section of Ogino provides an explanation of maximum intensity projection.

13. The control section 160 of Ogino controls the gradient driving section 130, the RF driving section 140, and the data collection section 150 to carry out imaging (Ogino, column 10, lines 5-9).

IX. ARGUMENT (41.37(o))

A. Claims 1-8, 11, and 17 Distinguish Patentably Over the References of Record

Claim 1 calls for an image producing device (which claim 4 indicates can be an MRI device or an x-ray projection device) and, in addition, a TOF-PET unit.

PET, of course, is the acronym for positron emission tomography which measures the distribution of a radionuclide in the body of a patient from annihilation quanta produced after the release of positrons (present application, page 1, lines 5-7). More specifically, the annihilation process generates two gamma quanta γ_1, γ_2 whose direction of flight is diametrically opposite (present application, page 5, lines 22-34). Conservation of momentum dictates that the two gamma rays must travel in diametrically opposite directions. Because the gamma quanta travel in opposite directions, the annihilation event must have occurred on the line, called in the present application a "reaction line", between the two detectors which detected the pair of quanta γ_1, γ_2 (present application, page 5, lines 22-34).

In time-of-flight positron emission tomography (TOF-PET), the detectors have such a high temporal resolution that differences in the time-of-flight of the two gamma quanta γ_1, γ_2 of the annihilation pair can be measured (present application, page 6, lines 1-12). From this

difference in the time-of-flight of the pair of gamma quanta, the location along the reaction line at which the annihilation event occurred can be calculated (present application, page 6, lines 1-12). Thus, in positron emission tomography, "time-of-flight" refers to the difference in travel or flight time of the two gamma rays of an annihilation pair from the annihilation event to the gamma ray detectors which detect them.

It appears that the Examiner has conducted a keyword search for "time-of-flight" and found a magnetic resonance imaging patent which uses the phrase "time-of-flight" to describe a different measurement which is unrelated to positron emission tomography. Specifically, the Ogino reference uses time-of-flight to describe a magnetic resonance technique for measuring a flow rate of blood (Ogino, column 11, lines 38-63). Thus, time-of-flight PET relates to localizing the annihilation event along a line; whereas, time-of-flight MR connotes measuring a time-of-flight of flowing blood (Ogino, column 1, lines 22-31). Moreover, there are no gamma rays or annihilation events in magnetic resonance imaging. Rather, in magnetic resonance imaging, the subject is placed in a static magnetic field, gradient magnetic fields and high frequency magnetic fields are applied to cause spins within the object to generate magnetic resonance signals (Ogino, column 1, lines 15-21).

For the reasons set forth above, it is submitted that Ogino is not, does not disclose, and does not relate to a TOF-PET unit.

The Office Action refers to the phase contrast (PC) magnetic resonance technique. Although this technique uses the word "contrast", it must be remembered that in a phase contrast magnetic resonance imaging technique, the "contrast" does not refer to a contrast or tracer which is injected into the patient's blood. Note that Ogino makes no reference to any contrast agent or the like being introduced into or otherwise being in the patient's blood. Rather, contrast refers to gray scale contrast. Ogino is particularly interested in having good contrast between blood and other tissues, so that it can be clearly seen in the resultant images (Ogino, column 15, lines 29-38). Indeed, phase contrast MRI is used to avoid the use of contrast agents or traces.

Phase contrast MRI is often used in magnetic resonance angiography (MRA) to image moving blood. The phase contrast sequences utilize change in the phase shifts of the flowing protons in the region of interest to create an image. Spins moving along the direction of the magnetic field gradient receive a phase shift proportional to their velocity. In phase contrast sequences, two data sets with different amounts of flow sensitivity are acquired. The data from these two sequences is subtracted, and by comparing the phase of the signals from each location in the two sequences, the exact amount of motion induced

phase change can be determined to generate a map in which pixel brightness is proportional to spatial velocity. Regions that are stationary remain black, while moving regions are represented as gray to white. For a basic primer, see any of the numerous US patents relating to phase contrast magnetic resonance imaging or see http://www.mr-tip.com/serv1.php?type=db1&dbs=phase%20contrast%20sequence.

Salem, which the Examiner cites for other purposes, relates to a CT scanner which operates on a different operating principle than both magnetic resonance imaging and PET. While a CT scanner or an MRI scanner could be the image producing device of claim 1, neither is, discloses, nor suggests a TOF-PET unit.

Lambrecht is cited for different purposes and does not cure this shortcoming of Ogino. While Lambrecht does disclose a PET system, Lambrecht does not disclose, show, or suggest a TOF-PET unit.

Claim 1 further calls for the TOF-PET unit to record the concentration of PET tracer in a predetermined volume element. The Examiner acknowledges that Ogino does not show in vivo determination of the concentration of a PET tracer and cites Salem for this purpose. However, Salem is a CT unit, not a TOF-PET unit, as discussed above. Thus, contrary to the Examiner's assertions, Salem does not cure this shortcoming of Ogino.

The Examiner asserts that it would be obvious to use the iodine-124 tracer of Lambrecht in Ogino. First, as discussed above, Ogino does not use a tracer, much less a PET tracer. To the contrary, Ogino uses PC-MRI which is sequence which does not use a tracer. Further, the Ogino magnetic resonance system would be insensitive to the presence or absence of iodine in the patient's blood or system. First, magnetic resonance imaging of blood and tissue is most commonly based on the hydrogen dipole of water or other organic materials. Indeed, magnetic resonance is limited to polar dipoles. Magnetic resonance imaging in the human body is most commonly based on resonating hydrogen dipoles, but may also be based on fluorine or phosphorus, but each has a very different resonance frequency. If iodine-124 were a resonant polar dipole, it would not be resonant at the same frequency as hydrogen, and thus would be invisible in a magnetic resonance imaging system designed based on hydrogen resonance.

Claim 1 calls for the processing unit to determine detector element positions of the TOF-PET unit in such a way that the volume element lies in the selected volume that is filled with blood. None of the references of record disclose or fairly suggest determining the position of detector elements. It is submitted that the radio frequency coils of Ogino which receive the resonance signals would, as in conventional MRI systems, be fixed or stationary during imaging. Similarly, a CT scanner

rotates around the region of interest. Salem provides no suggestion of a processing unit which determines the position of the CT detector elements which are normally rotating during imaging. Lambrecht does not disclose its detector structure, much less a processing unit which determines a position at which its detector structure should be located.

Claim 1 calls for an image producing device and a TOF-PET unit which interactively examine a common area of the subject under the control of the data processing unit. The Examiner cites Ogino, which discloses an MRI scanner only, and cites Salem, which discloses a CT scanner, and cites Lambrecht, which discloses a PET scanner (but not time-of-flight PET). The Examiner does not describe why or how one could bring these three diverse pieces of equipment together into a coherent unit which contemporaneously examine a common region of the subject. Nor has the Examiner explained how combining an MRI system, a CT system, and a conventional PET system would create a TOF-PET unit.

Accordingly, it is submitted that claim 1 and claims 2-8, 11, and 17 dependent therefrom distinguish patentably over the references of record.

B. Claim 2 Distinguishes Patentably Over the References of Record

Claim 2 calls for the evaluation electronics unit to record the times of flight of the pairs of detected annihilation quanta. Lambrecht does not disclose any electronic unit which can determine the time-of-flight of two radiation quanta. Indeed, although Lambrecht acknowledges the existence of PET instrument, it does not disclose any PET hardware. Figure 1 of Lambrecht is directed to a high pressure liquid chromatography system which is used to prepare solutions (Lambrecht, column 2, lines 64-66). Lambrecht provides no enabling disclosure of any hardware, much less hardware for recording times-of-flight of pairs of detected annihilation quanta. Ogino, which is directed to an MRI system, has no detectors for annihilation quanta and fails to cure this shortcoming of Lambrecht. Salem acknowledges the existence of various imaging systems, but discloses no hardware, much less hardware for recording times-of-flight of pairs of detected annihilation quanta.

Accordingly, it is submitted that claim 2 and claims 3 and 11 dependent therefrom distinguish patentably over the references of record.

C. Claim 3 Distinguishes Patentably Over the References of Record

Claim 3 calls for the effective area of each detector element to between 10 mm^2 and 400 mm^2. Lambrecht alludes to a standard PET

system, but discloses no hardware, much less a detector element, much less a detector element between 10 mm^2 and 400 mm^2. Ogino and Salem, which disclose no PET hardware, fail to cure this shortcoming of Lambrecht.

Accordingly, it is submitted that claim 3 distinguishes patentably over the references of record.

D. Claim 5 Distinguishes Patentably Over the References of Record

Claim 5 adds a 3D PET device to the image producing device and the TOF-PET unit of claim 1. That is, claim 5 calls for both a 3D PET device and a TOF-PET unit, as well as another image producing device. Contrary to the Examiner's assertion, Ogino does not disclose a PET device. Rather, Ogino is directed to an MRI system. Moreover, Ogino discloses no system which records the distribution of a PET tracer in a body region.

Again, Ogino does not disclose or suggest the use of any tracer, much less a PET tracer. Rather, Ogino teaches against using a tracer in favor of using a PC-MRI technique. Because the iodine tracer of Lambrecht would be invisible in the Ogino system, even if the patient were injected with the iodine tracer, it would not affect the MRI image of Ogino.

In discussing claim 5, the Examiner references maximum intensity projection, which has no relevance to the present claims. Maximum intensity projection is a technique for collapsing a three-dimensional volume image into a two-dimensional image. A ray is drawn from each pixel of the two-dimensional image into the three-dimensional image. The voxel of the three-dimensional image with the maximum intensity along each ray is determined and becomes the pixel value for the corresponding pixel of the two-dimensional image.

The Examiner also references Salem. Page 1312, column 2, paragraph B of Salem relates to display format and makes no suggestion nor does it even address adding a 3D PET device to the previously claimed TOF-PET unit and image producing device of claim 1.

Accordingly, it is submitted that claim 5 distinguishes patentably over the references of record.

E. Claim 6 Distinguishes Patentably Over the References of Record

Claim 6 calls for the data processing unit to segment the images produced by the image producing device to identify the body volume that is filled with blood. The Examiner references Figure 16 of Ogino. Neither Figure 16 of Ogino, nor the description of it at column 16, lines 47-62 describe or discuss segmenting an image. Rather, this section

of Ogino provides an explanation of maximum intensity projection. The Examiner points out that Lambrecht addresses annihilation quanta being detected by PET instruments. However, claim 6 relates to segmenting an image and does not add limitations directed to the detection of the annihilation quanta.

Accordingly, it is submitted that claim 6 distinguishes patentably and unobviously over the references of record.

F. Claim 9 Distinguishes Patentably Over the References of Record

Claim 9 calls for recording annihilation quanta coming out of a selected body volume taking into account their times-of-flight. Contrary to the Examiner's assertion, the MRI time-of-flight technique of Ogino does not take into account the time-of-flight of annihilation quanta. Rather, the time-of-flight MRI technique of Ogino uses MRI to measure the flow or time-of-flight of moving blood. Neither Salem nor Lambrecht disclose or fairly suggest recording annihilation quanta coming from a selected body volume taking into account their times-of-flight. Ogino produces no annihilation quanta. Phase contrast MRI is well-known in the art as an advantageous form of velocity measurement **which requires no contrast agent**. Rather, phase contrast MRI uses phase to enhance the contrast of the moving blood. If the Examiner believes that Ogino uses a

contrast agent or tracer, it is requested that the Examiner extend the courtesy of pointing out where in Ogino such disclosure can be found.

Accordingly, it is submitted that claim 9 and claims 10 and 11 dependent therefrom distinguish patentably and unobviously over the references of record.

G. Claim 10 Distinguishes Patentably Over the References of Record

Claim 10 calls for recording dynamic three-dimensional PET data in addition to the production of a locally-resolved image and in addition to recording of annihilation quanta, taking into account times-of-flight as set forth in claim 9. The Examiner has failed to point to any portion of any reference of record which discloses or fairly suggests concurrently acquiring data in three modes, much less in the three-dimensional PET mode in addition to a time-of-flight PET mode in addition to another imaging modality. Moreover, claim 10 calls for the three-dimensional PET data to be recorded in a further region of the body. The Examiner has failed to address or point out where in any of the references image data is generated and annihilation quanta with time-of-flight events are recorded from one area of the body while three-dimensional PET image data is acquired from another region of the body. The applicant traverses

the Examiner's assertion that the limitations of claim 10 have been addressed in conjunction with the rejection of the apparatus claims.

Accordingly, it is submitted that claim 10 distinguishes patentably and unobviously over the references of record.

H. Claim 11 Distinguishes Patentably Over the References of Record

Claim 11 calls for the TOF-PET unit to include only two detector elements. None of the references of record disclose or fairly suggest an annihilation quanta detection system that includes only two detector elements. Ogino is an MRI machine and includes no detector elements for detecting annihilation quanta. Salem and Lambrecht both allude to PET imaging systems, but describe and illustrate no hardware, much less hardware in which a PET system includes only two detectors. Moreover, because both Salem and Lambrecht allude only to conventional PET, not TOF-PET, it is submitted that neither shows any detectors for annihilation quanta pairs taking into account time-of-flight. Moreover, it is submitted that the conventional PET systems to which both Salem and Lambrecht allude would be PET **imaging** systems which traditionally include large arrays of detectors.

Accordingly, it is submitted that claim 11 distinguishes patentably and unobviously over the references of record.

I. Claim 17 Distinguishes Patentably Over the References of Record

Claim 17 calls for the data processing unit to control the positioning of the two gamma detector elements such that the volume element lies in the body volume. The Examiner refers the applicant to Figure 1, element 160. First, Ogino has no gamma detector elements. Ogino is an MR system. Second, the control section 160 of Ogino controls the gradient driving section 130, the RF driving section 140, and the data collection section 150 to carry out imaging (Ogino, column 10, lines 5-9). Controlling the gradient driving section 130 controls the gradient pulses which are applied in the imaging region and does not position a gamma detector or any other structure. Controlling the RF driving section 140 controls the RF pulses transmitted by RF antennas, but does not control the positioning of a gamma detector or any other element. Controlling the data collection section to carry out imaging relates to processing the resonance data to convert the received resonance data into an image. Reconstructing resonance data into an image does not control the positioning of a gamma detector or any other structure.

Accordingly, it is submitted that claim 17 distinguishes patentably and unobviously over the references of record.

J. **Claim 10 Complies With 35 U.S.C. § 112**

If the accompanying Amendment After Final is entered, it is believe that the 35 U.S.C. § 112 issue will be resolved.

If the accompanying Amendment After Final is not entered, then it is submitted that claim 10 complies with the requirements of 35 U.S.C. § 112. Specifically, it is submitted that "the dynamic PET data" in line 6 of claim 10 finds clear antecedent basis in "dynamic, three-dimensional, PET data" recited in claim 10, lines 3 and 4. Even though the two phrases are not verbatim identical, it is submitted that the antecedent basis is clear. Neither claim 10 nor its parent claim 9 set forth any other "PET data" or any other "dynamic PET data" other than the "dynamic, three-dimensional, PET data" recited in lines 3 and 4 of claim 10.

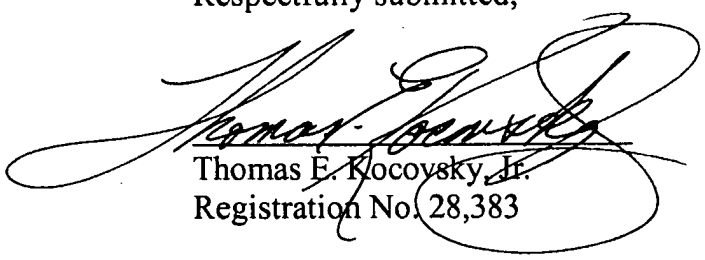
Accordingly, it is submitted that the reader of claim 10 will readily understand the antecedent basis of "the dynamic PET data" and that there will no confusion or ambiguity regarding claim 10. Specifically, it is submitted that claim 10, as written, is definite and particularly points out and distinctly claims the subject matter which the applicant regards as the invention.

Accordingly, it is submitted that claim 10 complies with the requirements of 35 U.S.C. § 112, second paragraph.

K. CONCLUSION

For all of the reasons discussed above, it is respectfully submitted that claims 1-11 and 17 distinguish patentably and unobviously over the references of record. For all of the above reasons, a reversal of the rejections of all claims is requested.

Respectfully submitted,



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APPENDIX

X. CLAIMS SECTION (41.37(p))

1. (Rejected) A device for *in vivo* determination of a concentration of a PET tracer in blood, including:

an image-producing device which generates a locally resolved depiction of a region of the body including a body volume that is filled with blood;

a TOF-PET unit for recording the concentration of the PET tracer in a predetermined volume element;

a data processing unit which is coupled to the image-producing device and the TOF-PET unit, the data processing unit in conjunction with the image-producing device determines a spatial position of the body volume that is filled with blood and determines detector element positions of the TOF-PET unit such that the volume element of the TOF-PET unit lies in the body volume that is filled with blood.

2. (Rejected) The device as claimed in claim 1, wherein the TOF-PET unit comprises:

two γ detector elements that detect pairs of annihilation quanta, the two γ detector elements lie opposite one another and define the predetermined volume element on a line therebetween, and

corresponding evaluation electronics unit for recording times of flight of the pairs of detected annihilation quanta.

3. (Rejected) The device as claimed in claim 2, wherein the effective area of each detector element is between 10 mm^2 and 400 mm^2.

4. (Rejected) The device as claimed in claim 1, wherein the image-producing device includes one of an MRI device and an X-ray projection device.

5. (Rejected) The device as claimed in claim 1, further including a 3D PET device which records a three-dimensional distribution of the PET tracer in a body region.

6. (Rejected) The device as claimed in claim 1, wherein the data processing unit segments images produced by the image-producing device to identify the body volume that is filled with blood.

7. (Rejected) The device as claimed in claim 1, further including a display device for displaying images that have been produced with the image-producing device and an input means for interactive selection of a body volume in the displayed images.

8. (Rejected) The device as claimed in claim 1, wherein the body volume filled with blood lies in an aorta or in a left ventricle of a heart.

9. (Rejected) A method for the *in vivo* determination of the concentration of a PET tracer in the blood, comprising the steps of:

- production of at least one locally resolved image of a body region;
- determination of the spatial position of a body volume filled with blood on the basis of the image produced;
- recording of annihilation quanta coming out of the body volume, taking account of their times of flight.

10. (Rejected) The method as claimed in claim 9, further including:

recording dynamic, three-dimensional, PET data in a further body region , and combining the determined concentration of the PET tracer in the blood with the dynamic, three dimensional, PET data.

11. (Rejected) The device as claimed in claim 2, wherein the TOF-PET unit includes only two detector elements to detect annihilation quanta pairs travelling along the line therebetween.

12. (Withdrawn) A method of determining a concentration of a PET tracer *in vivo*, the method comprising:

generating a diagnostic image of a region of a patient, which region includes a blood filled body volume;

identifying a location of the blood filled body volume from the diagnostic image;

determining positions of a pair of TOF-PET detectors on opposite sides of the blood filled body volume such that a line between the pair of TOF-PET detectors passes through the blood filled body volume;

detecting pairs of annihilation quanta from a PET tracer in the blood with the pair of TOF-PET detectors;

using time of flight information to identify pairs of annihilation quanta emitted from the blood filled body volume;

determining a concentration of the PET tracer in the blood from the detected annihilation quanta pairs emitted from the blood in the blood filled body volume.

13. (Withdrawn) The method as claimed in claim 12, further including:

generating temporally dynamic PET images of another region of the patient concurrently with determining the concentration of PET tracer in the blood;

associating the temporally dynamic PET images with the concurrently determined PET tracer concentration.

14. (Withdrawn) A device for determining a concentration of a PET tracer in blood *in vivo*, the device comprising:

a diagnostic imaging device;

a pair of TOF-PET detectors; and

a data processor programmed to control the diagnostic imaging device and the pair of TOF-PET detectors and perform **the method as claimed in claim 12**.

15. (Withdrawn) The device as claimed in claim 14, wherein the pair of TOF-PET detectors is a one-dimensional that determines annihilation event locations along the line between the pair of TOF-PET detectors.

16. (Withdrawn) The method as claimed in claim 12, further including:

positioning the pair of TOF-PET detectors such that the line therebetween passes through the blood filled cavity.

17. (Rejected) The device as claimed in claim 2, wherein the data processing unit further controls positioning the two γ detector elements such that the volume element on the line therebetween lies in the body volume.

APPENDIX (Continued)

XI. CLAIM SUPPORT AND DRAWING ANALYSIS SECTION (41.37(r))

1. A device for *in vivo* determination of a concentration of a PET tracer in blood, including: **{p. 1, l. 1-2}**

an image-producing device **{5, 6}** which generates a locally resolved depiction of a region of the body including a body volume that is filled with blood; **{p. 1, l. 26 – p. 2, l. 2; p. 4, l. 2 – p. 5, l. 7; p. 7, l. 2-3}**

a TOF-PET unit **{3a, 3b}** for recording the concentration of the PET tracer in a predetermined volume element **{2}**; **{p. 2, l. 3-10; p. 5, l. 16-34; p. 7, l. 5-6}**

a data processing unit **{7}** which is coupled to the image-producing device **{5,6}** and the TOF-PET unit **{3a, 3b}**, the data processing unit in conjunction with the image-producing device determines a spatial position **{r}** of the body volume that is filled with blood and determines detector element positions of the TOF-PET unit such that the volume element **{2}** of the TOF-PET unit lies in the body volume that is filled with blood. **{p. 2, l. 11-15; p. 5, l. 13-17; p. 7, l. 7-11}**

2. The device as claimed in claim 1, wherein the TOF-PET unit comprises:

two γ detector elements that detect pairs of annihilation quanta, the two γ detector elements **{3a, 3b}** lie opposite one another and define the predetermined volume element **{2}** on a line therebetween, and **{p. 2, l. 3-10; p. 5, l. 22 – p. 6, l. 12; p. 7, l. 13-14}**

corresponding evaluation electronics unit for recording times of flight of the pairs of detected annihilation quanta { γ_1, γ_2}. **{p. 2, l. 3-10; p. 7, l. 15-16}**

3. The device as claimed in claim 2, wherein the effective area of each detector element **{3a, 3b}** is between 10 mm^2 and 400 mm^2. **{p. 3, l. 18; p. 7, l. 18-19}**

4. The device as claimed in claim 1, wherein the image-producing device **{4, 5}** includes one of an MRI device and an X-ray projection device. **{p. 3, l. 22-25; p. 7, l. 21-23}**

5. The device as claimed in claim 1, further including a 3D PET device **{4}** which records a three-dimensional distribution of the PET tracer in a body region. **{p. 3, l. 26-32; p. 6, l. 19-25; p. 7, l. 25-27}**

6. The device as claimed in claim 1, wherein the data processing unit {7} segments images {A} produced by the image-producing device to identify the body volume that is filled with blood. **{p. 3, l. 33 – p. 4, l. 2; p. 5, l. 10-12; p. 8, l. 1-3}**

7. The device as claimed in claim 1, further including a display device **{8}** for displaying images **{A}** that have been produced with the image-producing device **{5, 6}** and an input means **{9}** for interactive selection of a body volume in the displayed images. **{p. 4, l. 3-9; p. 5, l. 3-12; p. 8, l. 5-8}**

8. The device as claimed in claim 1, wherein the body volume filled with blood lies in an aorta or in a left ventricle of a heart. **{p. 2, l. 19; p. 4, l. 10-12; p. 8, l. 10-11}**

9. A method for the *in vivo* determination of the concentration of a PET tracer in the blood, comprising the steps of: **{p. 4, l. 13-14; p. 8, l. 13-14}**

- production of at least one locally resolved image **{A}** of a body region; **{p. 4, l. 15; p. 8, l. 15}**

- determination of the spatial position {T} of a body volume filled with blood on the basis of the image {A} produced; **{p. 4, l. 16-17; p. 8, l. 16-17}**

- recording of annihilation quanta { γ_1, γ_2} coming out of the body volume, taking account of their times of flight. **{p. 4, l. 18-19; p. 8, l. 18-19}**

10. The method as claimed in claim 9, further including:

recording dynamic, three-dimensional, PET data in a further body region , and combining the determined concentration of the PET tracer in the blood with the dynamic, three dimensional, PET data. **{p. 4, l. 23-28; p. 8, l. 21-23}**

11. The device as claimed in claim 2, wherein the TOF-PET unit includes only two detector elements **{3a, 3b}** to detect annihilation quanta pairs travelling along the line therebetween. **{p. 3, l. 5-16; p. 5, l. 22-34}**

12-16. (Withdrawn)

17. The device as claimed in claim 2, wherein the data processing unit **{7}** further controls positioning the two γ detector

elements **{3a, 3b}** such that the volume element **{2}** on the line therebetween lies in the body volume. **{p. 6, l. 5-18}**

APPENDIX (Continued)

XII. MEANS OR STEP PLUS FUNCTION ANALYSIS SECTION (41.37(s))

1. A device for *in vivo* determination of a concentration of a PET tracer in blood, including: **{p. 1, l. 1-2}**

an image-producing device **{5, 6}** which generates a locally resolved depiction of a region of the body including a body volume that is filled with blood; **{p. 1, l. 26 – p. 2, l. 2; p. 4, l. 2 – p. 5, l. 7; p. 7, l. 2-3}**

a TOF-PET unit **{3a, 3b}** for recording the concentration of the PET tracer in a predetermined volume element **{2}**; **{p. 2, l. 3-10; p. 5, l. 16-34; p. 7, l. 5-6}**

a data processing unit **{7}** which is coupled to the image-producing device **{5,6}** and the TOF-PET unit **{3a, 3b}**, the data processing unit in conjunction with the image-producing device determines a spatial position **{r}** of the body volume that is filled with blood and determines detector element positions of the TOF-PET unit such that the volume element **{2}** of the TOF-PET unit lies in the body volume that is filled with blood. **{p. 2, l. 11-15; p. 5, l. 13-17; p. 7, l. 7-11}**

2. The device as claimed in claim 1, wherein the TOF-PET unit comprises:

two γ detector elements that detect pairs of annihilation quanta, the two γ detector elements **{3a, 3b}** lie opposite one another and define the predetermined volume element **{2}** on a line therebetween, and **{p. 2, l. 3-10; p. 5, l. 22 – p. 6, l. 12; p. 7, l. 13-14}**

corresponding evaluation electronics unit for recording times of flight of the pairs of detected annihilation quanta { γ_1, γ_2}. **{p. 2, l. 3-10; p. 7, l. 15-16}**

3. The device as claimed in claim 2, wherein the effective area of each detector element **{3a, 3b}** is between 10 mm^2 and 400 mm^2. **{p. 3, l. 18; p. 7, l. 18-19}**

4. The device as claimed in claim 1, wherein the image-producing device **{4, 5}** includes one of an MRI device and an X-ray projection device. **{p. 3, l. 22-25; p. 7, l. 21-23}**

5. The device as claimed in claim 1, further including a 3D PET device **{4}** which records a three-dimensional distribution of the PET tracer in a body region. **{p. 3, l. 26-32; p. 6, l. 19-25; p. 7, l. 25-27}**

6. The device as claimed in claim 1, wherein the data processing unit {7} segments images {A} produced by the image-producing device to identify the body volume that is filled with blood. **{p. 3, l. 33 – p. 4, l. 2; p. 5, l. 10-12; p. 8, l. 1-3}**

7. The device as claimed in claim 1, further including a display device {8} for displaying images {A} that have been produced with the image-producing device {5, 6} and an input means {9} for interactive selection of a body volume in the displayed images. **{p. 4, l. 3-9; p. 5, l. 3-12; p. 8, l. 5-8}**

8. The device as claimed in claim 1, wherein the body volume filled with blood lies in an aorta or in a left ventricle of a heart. **{p. 2, l. 19; p. 4, l. 10-12; p. 8, l. 10-11}**

9. A method for the *in vivo* determination of the concentration of a PET tracer in the blood, comprising the steps of: **{p. 4, l. 13-14; p. 8, l. 13-14}**

- production of at least one locally resolved image {A} of a body region; **{p. 4, l. 15; p. 8, l. 15}**

- determination of the spatial position {T} of a body volume filled with blood on the basis of the image {A} produced; **{p. 4, l. 16-17; p. 8, l. 16-17}**

- recording of annihilation quanta { γ_1, γ_2} coming out of the body volume, taking account of their times of flight. **{p. 4, l. 18-19; p. 8, l. 18-19}**

10. The method as claimed in claim 9, further including:

recording dynamic, three-dimensional, PET data in a further body region , and combining the determined concentration of the PET tracer in the blood with the dynamic, three dimensional, PET data. **{p. 4, l. 23-28; p. 8, l. 21-23}**

11. The device as claimed in claim 2, wherein the TOF-PET unit includes only two detector elements **{3a, 3b}** to detect annihilation quanta pairs travelling along the line therebetween. **{p. 3, l. 5-16; p. 5, l. 22-34}**

12-16. (Withdrawn)

17. The device as claimed in claim 2, wherein the data processing unit **{7}** further controls positioning the two γ detector

elements **{3a, 3b}** such that the volume element **{2}** on the line therebetween lies in the body volume. **{p. 6, l. 5-18}**

APPENDIX (Continued)

XIII. EVIDENCE SECTION (41.37(t))

Not applicable.

APPENDIX (Continued)

XIV. RELATED CASES SECTION (41.37(u))

None.